

CLAIMS

1. An apparatus, comprising:

an electrode capable of being positioned over a substrate location, the electrode having a center region, a first surface and a second surface, the first surface being configured to receive processing gases and to enable flow of the processing gases through the center region, the second surface having a plurality of gas feed holes that are coupled to a corresponding plurality of electrode openings having electrode opening diameters that are greater than gas feed hole diameters of the plurality of gas feed holes, the plurality of electrode openings being configured to define the second surface which is located over the substrate location, the second surface having a surface area that is larger than a surface area of the substrate location, the larger surface area being capable of inducing an increased bias voltage at a point closer to the substrate location and a decreased bias voltage at a point closer to the second surface of the electrode when a plasma is struck in a space defined between the second surface and the substrate location.

2. The apparatus of claim 1, wherein a first plasma sheath surface is defined next to the substrate location and a second plasma sheath surface is defined next to the second surface, and the second plasma sheath surface follows an outline defined by the plurality of electrode openings of the second surface of the electrode.

3. The apparatus of claim 2, wherein the first plasma sheath surface has a first sheath surface area and the second plasma sheath surface has a second sheath surface area, and the second sheath surface area is larger than the first sheath surface area.

4. The apparatus of claim 1, wherein each one of the plurality of electrode openings is at least about 0.5 mm or greater in diameter and each one of the plurality of gas feed holes has a diameter of about 0.1 mm.

5. An electrode, comprising:

an electrode body having a first surface and a second surface, the second surface having a plurality of gas feed holes that are coupled to a corresponding plurality of electrode openings, each electrode opening having an electrode opening diameter that is greater than a gas feed hole diameter of each of the plurality of gas feed holes, the second surface being defined by inner surfaces of the plurality of electrode openings so that a surface area of the second surface is larger than a surface area of the electrode body without the plurality of electrode openings, the larger second surface area being capable of inducing an increased bias voltage at a substrate processing surface.

6. The electrode of claim 5, wherein a plasma is defined between the second surface of the electrode and a substrate surface, the substrate surface being disposed adjacent to the second surface of the electrode, and with the second surface of the electrode, defining a processing space in which the plasma is defined.

7. The electrode of claim 6, wherein a plasma sheath having a first sheath surface and a second sheath surface is defined in the processing space, the first sheath surface being defined next to the substrate surface and the second sheath surface being

defined next to the second surface of the electrode, the second sheath surface following an outline defined by the plurality of electrode openings of the second surface of the electrode.

8. The electrode of claim 5, wherein each of the plurality of electrode openings is at least about 0.5 mm or greater in diameter and each of the plurality of gas feed holes has a diameter of about 0.1 mm.

9. An electrode, comprising:
an electrode body including,
a first surface; and
a second surface, the second surface having a plurality of gas feed holes, each one of the plurality of gas feed holes being integrally coupled to a corresponding electrode opening to comprise a plurality of electrode openings, each one of the plurality of electrode openings being larger than each one of the plurality of gas feed holes, the second surface defining a boundary of a plasma sheath, the plasma sheath having a first plasma sheath surface and a second plasma sheath surface, the second plasma sheath surface being at least partially within the plurality of electrode openings.

10. The electrode of claim 9, wherein the first plasma sheath surface is adjacent to a processing surface of a substrate, the first plasma sheath surface having a first plasma sheath surface area which is smaller than a second plasma sheath surface area of the second plasma sheath surface.

11. The electrode of claim 9, wherein when the second plasma sheath surface that is at least partially within the plurality of electrode openings causes an increase in bias voltage to be directed at an active surface of a substrate.

12. The electrode of claim 10, wherein the second plasma sheath surface area is about 2.7 times greater than the first plasma sheath surface area.

13. An electrode, comprising:

an electrode body having a process surface, the process surface having a plurality of gas feed holes, each gas feed hole being integrally coupled to a corresponding electrode opening, the electrode opening being larger than the gas feed hole, the process surface defining a plasma sheath having a surface that is at least partially within each electrode opening.

14. The electrode of claim 13, wherein each electrode opening is at least about 0.5 mm or greater in diameter and each gas feed hole has a diameter of about 0.1 mm, and wherein when a plasma is struck adjacent to the electrode, the plasma sheath shifts to be at least partially within each electrode opening.